

Malocclusion and Deleterious Oral Habits in Vietnamese Children Between the Ages of 8 and 12 years: A Cross Sectional Study

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ABSTRACT

Aim: This study aimed to determine the relationship between malocclusion and deleterious oral habits in the Vietnamese children aged 8–12 years. **Materials and Methods:** A cross-sectional descriptive analysis was undertaken on a total of 434 children (8–12 years old, 208 males and 226 females), separated into five age groups: 8 years old (16.8%), 9 years old (18.5%), 10 years old (20.7%), 11 years old (21.4%), and 12 years old (22.6%), with all four first permanent molars erupted, no previous orthodontic treatment, loss of the second primary molar or presence of the second primary molar root or decay, loss of surface material on the second primary molar, and underfilling of the second primary molar size in the mesiodistal direction. The deleterious oral habits and malocclusion were assessed through a clinical examination and questionnaires for parents. The descriptive statistical analysis revealed the following findings: mean and standard deviation. The chi-squared test and Fisher's exact test were used to compare categorical variables. The data were considered significant at $P < 0.05$. **Result:** Deleterious oral habits were found to have a significant relationship with malocclusion. Mouth breathing habits were associated with anterior open bites ($P < 0.05$). The tongue thrusting habit was associated with anterior open bite ($P < 0.05$), posterior crossbite ($P < 0.01$), overbite greater than 4 mm ($P < 0.01$), and angle class I malocclusion ($P < 0.05$). Chewing habits on one side were associated with posterior crossbite ($P < 0.01$) and posterior open bite ($P < 0.05$). The habit of pen/pencil/nail biting was associated with midline deviation ($P < 0.05$). As children got older, there was a greater need for orthodontic treatment for dental healthcare, according to the index of orthodontic treatment need. In the 8-year-old patient group, the need was 4.1%; in the 9-year-old patient group, it was 5%; in the 10-year-old patient group, it was 9%; in the 11-year-old patient group, it was 19.4%; and in the 12-year-old patient group, it was 22.4%. The distribution of orthodontic treatment needs for dental health was significantly different based on the number of deleterious oral habits children had ($P < 0.01$). **Conclusion:** Abnormal oral habits were prevalent in about 30.6% of the study participants. Mouth breathing, tongue thrusting, pen/pencil/nail biting, and one-side chewing had a significant impact on malocclusion.

KEYWORDS: Deleterious oral habits, index of orthodontic treatment need (IOTN), malocclusion, the Vietnamese population

Received : 24-May-2024
Revised : 01-Aug-2024
Accepted : 16-Aug-2024
Published : 29-Oct-2024

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How to cite this article: Nguyen TP, Le LN, Le KP. Malocclusion and deleterious oral habits Vietnamese children between the ages of 8 and 12 years: A cross sectional study. J Int Soc Prevent Communit Dent 2024;14:369-78.

Access this article online

Quick Response Code:



Website: <https://journals.lww.com/jpcd>

DOI: 10.4103/jispcd.jispcd_72_24

INTRODUCTION

Poor dental habits have a significant impact on children, leading to a mixed dentition. Continuing these practices throughout the transition from primary teeth to permanent teeth may lead to improper alignment of the teeth, impede the natural development of the face, and impair the functioning of the neuromuscular–orofacial system.^[1,2] Detecting and swiftly eliminating undesirable oral habits during the formation of baby teeth or mixed-tooth period might facilitate self-correction or prevent worsening tooth misalignments, reducing the need for orthodontic treatment.^[3,4] According to the American Dental Association, the optimal period for orthodontic treatment is between the ages of 10 and 12 years.^[5] This timeframe allows for prompt identification of malocclusion, as well as its underlying causes and contributing factors. Similarly, orthodontic intervention at this stage is very advantageous due to the short intervention duration and low treatment costs. This is attributed to the incomplete development of the skeletal and periodontal tissue at this stage. A comprehensive evaluation tool, the index of orthodontic treatment need (IOTN), can assess malocclusion both clinically and on cast models. It is often used in epidemiological studies and is regarded as the best clinical assessment index compared to other indices. The IOTN consists of two components: (1) dental health components and (2) esthetic components.^[6,7]

A study conducted by Nidhi Pruthi (2013) studied the prevalence of deleterious oral habits and malocclusion in 961 children aged 12–15 years in Shimla City, India. The results revealed that 25.9% of children showed deleterious dental habits, whereas 52.7% of children had malocclusion. Furthermore, it was observed that the prevalence of malocclusion was greater among children with deleterious dental habits, namely, 28.8%. Among children who did not have deleterious oral habits, the observed difference was statistically significant ($P < 0.05$).^[8] In another study, Garde^[9] studied the deleterious oral habits of children aged 6–12 years in India. The study showed that 51% of the children had deleterious oral habits. The most prevalent behavior found was tooth grinding, with a prevalence rate of 17.3%.^[9] Giusepina Lagana (2013) from Albania examined the prevalence of deleterious oral habits, malocclusion, and the need for orthodontic treatment in children aged 7–15 years, as determined by the IOTN. The results revealed that 80.6% of the children had deleterious oral habits.^[10] Oral habits, if extended beyond the preschool age, may cause various types

of malocclusions, which in the future may require orthodontic intervention. As the duration of the habit increases, the probability of a child developing a class II malocclusion also increases. If the habit was stopped early (before 6 years), the effects on occlusion were often transitory.^[11,12]

The knowledge of the prevalence and causes of malocclusion helps formulate strategies for prevention, interception, and corrective treatment. In Vietnam, there is currently limited published data on malocclusion. Few studies including 12- and 18-year-old pupils in northern Vietnam indicated that the rates of Angle Class I, Class II, and Class III malocclusion were 19%, 31%, and 10.7%, respectively.^[13] In the central region of Vietnam, the incidences of Angle Class I, Class II, and Class III malocclusion were 67%, 17.5%, and 15.5% of the population, respectively.^[14] We have omitted data from southern Vietnam. Furthermore, there has been no significant investigation into the impact of students' health habits on malocclusion. In developing countries like Vietnam, where there is a lack of public dental treatment programs and budgets are constrained due to the high cost of orthodontic services, it is particularly important to recognize the severity of orthodontic treatment needs and identify modifiable factors to target through preventive and interceptive orthodontics. Thus, the goal of this current study was to determine the relationship between malocclusion and deleterious oral habits in the Vietnamese population of children aged 8–12 years. Providing this information is critical in developing proper strategies for the advancement of dental care services for children. Additionally, the school can utilize this information to create research-based oral care plans, which can aid in guiding and teaching children about oral health communication, as well as restricting inappropriate behavior that could potentially harm their dental health.

MATERIALS AND METHODS

STUDY PARTICIPANTS

Inclusion criteria: between the ages of 8 and 12 years, the eruption of all four permanent first molars was complete, with no signs of tilting toward the mesially, distally, buccal, or lingually; the primary second molar was not lost or decayed on its surface. In the mesiodistal direction, the filling on the second primary molar was lacking in size, agreed to engage in the study, had no medical conditions participated fully in the examination and interviews, and had a questionnaire completed by their parents. Excluded criteria: children who have already undergone orthodontic treatment.

ETHICS COMMITTEE APPROVAL

Ethics committee approval was received for this study from the Ethics Committee in Biological Research of Can Tho University of Medicine and Pharmacy.

STUDY METHODS

A cross-sectional descriptive analysis was performed on a cohort of 434 children, aged 8–12 years, consisting of 208 males and 226 females. The sample included all children within this age range from a single school in Vietnam. According to the data, there were a total of 850 children enrolled in the school at the time of sampling; all of them were between the ages of 8 and 12 years. The current study examined a total of 434 children who satisfied the specified sample standards. The study received approval from the Ethics Council in Biomedical Research at the Can Tho University of Medicine and Pharmacy.

The data collection procedure involved clinical examinations conducted by two competent general dental practitioners. The Department of Pediatric Dentistry and Orthodontics at CTUMP trained and calibrated the examiner to ensure standardized recording criteria. The practitioners utilize a variety of instruments, such as a calibrated ruler, a facial mirror, a light source, and mittens. The examinations were conducted at the respective institutions using the World Health Organization's (WHO) standard periodontal probe (CPI probe), an oral mirror, and natural daylight illumination.^[15] The training and calibration process for eradicating oral habits took place in a face-to-face interview, where the individuals self-reported their habits. Participants were assessed for a variety of behaviors, including thumb grasping, lip biting, teeth grinding, tongue thrusting, mouth breathing, and chewing pens, pencils, or nails. A clinical examination was performed to ascertain the presence or absence of an aberrant tongue thrust during ingestion. A comprehensive discussion of each category, including the resolution of potential disagreements, was conducted. The training session was called to a close when a satisfactory level of agreement and comprehension was achieved.

STUDY PROCEDURE

We gathered data on the number and particular list of children aged 8–12 years enrolled in the school and selected children who fulfilled the criteria for sampling. Subsequently, we sent an invitation to enroll in the study, along with a questionnaire for parents to complete in the comfort of their own homes. The next step involved collecting consent forms and surveys from the parents. The school's dental office individually welcomed each child in the study sample and positioned them in front

of the interviewer. After talking to the person directly, the evaluators wrote down several occlusal parameters. These include the relationships between the molars and canines, measurements of overbite and overjet, an evaluation of the anterior open bite, an analysis of spacing and crowding, identification of an anterior crossbite, presence of a scissors bite, and observation of a posterior crossbite. Additionally, students were requested to report their behaviors concerning the early loss of deciduous teeth, finger grasping, lip biting, tongue protrusion, mouth breathing, and mouth breathing through clinical examination and observation. A survey was administered to parents and guardians to collect information regarding nail biting and thumb/finger grasping, while a clinical examination was conducted in both natural and artificial light to evaluate the propensity for lip/tongue interposition. To facilitate the examination, disposable tongue depressors were implemented [Table 1]. After each survey session, the student's records were verified, which should include six photographs of both the intraoral and extraoral subjects, to prevent any omissions. Children whose recorded information was ambiguous will undergo reexamination. Ultimately, the data were inputted into the data collection table and analyzed using Statistical Package for Social Sciences (SPSS, IBM Corp, Armonk, New York, USA) version 20.0 statistical software.

STATISTICAL ANALYSIS

The statistical analysis was performed using SPSS version 18.0. The following are the findings of descriptive statistical analysis: mean and standard deviation. Statistical tests used were the chi square test or Fisher's exact test for comparing categorical variables.

RESULTS

A study of 434 children aged 8–12 years found that 69.4% had deleterious oral habits, with chewing on one side being the most detrimental habit. The 12-year-olds made up the largest percentage of children, 22.6%. The lowest percentage was composed by 8-year-olds at 16.8%. The study also found no instances of thumb-sucking behavior. The findings highlight the importance of maintaining healthy oral habits in children [Table 2]. The study found a significant correlation between mouth breathing habits and anterior open bite, as well as tongue thrusting habits, posterior crossbite, anterior open bite, overbite, and Angle Class I malocclusion. Biting on pens, pencils, or nails significantly correlated with midline deviation, while chewing on one side was strongly associated

Table 1: Several approaches to determine the study sample’s deleterious oral habits

Type of oral habit present ¹	Information collected via the questionnaire	Information collected via clinical examination
Mouth breathing	<ul style="list-style-type: none"> • Condition of lips closed while sleeping • Condition of lips closed when awake • Nose/mouth breathing habits 	<ul style="list-style-type: none"> • Inspection of the nose and breathing conditions • In the resting position and when compelled to close, evaluate the lips and the condition of lip closure • The baby’s mouth obscures the mirror surface during the mirror test
Tongue thrusting	<ul style="list-style-type: none"> • Tendency to protrude the tongue • During sleep or upon awakening, the habit involves positioning the tongue laterally between the two dental arches 	<ul style="list-style-type: none"> • Inspect the tongue and its location (at rest) • Conduct a thorough examination of the tongue and perform a salivary swallow test
One side chewing	<ul style="list-style-type: none"> • Tendency to masticate on either one or both sides 	<ul style="list-style-type: none"> • Tartar is concentrated on one side
Thumb-sucking	<ul style="list-style-type: none"> • Thumb-sucking habit 	<ul style="list-style-type: none"> • Finger examination
Lip biting	<ul style="list-style-type: none"> • Oral fixation of sucking or biting the lips 	<ul style="list-style-type: none"> • Oral examination (marks made by teeth on the lips)
Cheek biting	<ul style="list-style-type: none"> • Analysis of the mucous membrane of the cheek 	<ul style="list-style-type: none"> • Analysis of the mucous membrane of the cheek
Pen/pencil/ nail biting	<ul style="list-style-type: none"> • Pen/pencil/nail biting habit 	<ul style="list-style-type: none"> • Examination of nails
Grinding of teeth	<ul style="list-style-type: none"> • Interview questionnaire for parents on children’s nighttime bruxism 	

Table 2: Selected characteristics of the study sample

Variables		n	%
Age (years)	8	73	16.8
	9	80	18.5
	10	90	20.7
	11	93	21.4
	12	98	22.6
Gender	Male	208	47.9
	Female	226	52.1
Deleterious oral habits	Presence	133	30.6
	Absence	301	69.4
Angle malocclusion	Normal occlusion	64	14.7
	Angle class I	115	26.5
	Angle class II	50	11.5
	Angle class III	100	23
	Unknown ¹	105	24.2
Type of oral habit present ²	Mouth breathing	91	21
	Tongue thrusting	35	8.1
	One side chewing	144	33.2
	Thumb-sucking	-	-
	Lip biting	38	8.8
	Cheek biting	19	4.4
	Pen/pencil/nail biting	123	28.3
	Grinding of teeth	55	12.7

¹The molar relationships on the right and left sides were different.

²Several children had multiple oral habits, resulting in a discrepancy between this number and the amount mentioned above for “any habit present.” The percentage is calculated for a total of 434 subjects

impact bite outcomes [Table 3]. The study found no significant difference in the prevalence of deleterious oral habits across age groups, but lip-sucking, pen/pencil biting, and nail biting were more common among 8- and 9-year-olds, decreasing around 10- to 11-year-olds and continuing to decrease among 12-year-olds, indicating a general trend [Table 4]. Some of the occlusal features that change a lot with age are malocclusion ($P < 0.001$), overbite (> 4 mm, $P < 0.05$), posterior crossbite ($P < 0.01$), and tooth position deviation ($P < 0.01$) [Table 5]. Children with anterior open bites were found to be more likely to have poor mouth breathing, poor tongue thrusting, and a posterior crossbite. Tongue-thrusting children had an 8.6% anterior open bite, and habitual tongue thrusting was 37.3 times more likely than non-thrusting in children. Tongue-thrusting children had an overbite (62.9%), angle class I malocclusion (42.9%), and one-sided chewers were 5.2 times more likely to posteriorly crossbite (8.3%). Bad one-sided chewers had an anterior open bite (8.3%), and pen/pencil/nail-biting children exhibited mismatched midlines (71.2%). These findings highlight the importance of understanding and addressing these conditions in children to prevent further harm [Table 6]. A study found that 272 children did not require therapy, with the highest percentage at 62.9%. The average treatment requirement was 24.4%, and 12.7% was significantly lower [Figure 1]. Over 50% of children in each age group did not require therapy. The need for therapy increased with age, with the most significant needs

with posterior crossbite and posterior open bite. These findings suggest that oral hygiene practices can

Table 3: Frequency distribution of malocclusion traits and oral habits present

	Oral habit present ¹						
	Mouth breathing	Tongue thrusting	One side chewing	Lip biting	Cheek biting	Pen/pencil/nail biting	Grinding of teeth
Angle malocclusion							
Angle class I	24 (5.5)	15 (3.4)	45 (10.4)	11 (2.5)	6 (1.4)	36 (8.3)	13 (3)
Angle class II	9 (2.1)	4 (0.9)	15 (3.4)	6 (1.4)	3 (0.7)	20 (4.6)	16 (3.7)
Angle class III	23 (5.3)	8 (1.8)	33 (7.6)	5 (1.1)	4 (0.9)	8 (1.8)	15 (3.4)
Overjet							
> 4 mm	25 (5.8)	22 (5.1)	27 (6.2)	8 (1.8)	6 (1.4)	28 (6.5)	11 (2.5)
< 0 mm (cross bite)	7 (1.6)	2 (0.5)	10 (2.3)	4 (0.9)	1 (0.2)	10 (2.3)	3 (0.7)
Overbite							
> 4 mm	12 (2.8)	10 (2.3)	25 (5.8)	7 (1.6)	6 (1.4)	19 (4.3)	6 (1.4)
< 0 mm (open bite)	3 (0.7)	3 (0.7)	2 (0.5)	–	1 (0.2)	2 (0.5)	–
Posterior							
Crossbite	6 (1.4)	5 (1.1)	10 (2.3)	4 (0.9)	2 (0.5)	6 (1.4)	2 (0.5)
Scissors bite	2 (0.5)	6 (1.4)	12 (2.8)	2 (0.5)	1 (0.2)	1 (0.2)	2 (0.5)
Open bite	2 (0.5)	2 (0.5)	12 (2.8)	2 (0.5)	2 (0.5)	1 (0.2)	1 (0.2)
Diastema midline ≥1 mm							
Presence	56 (12.9)	22 (5.1)	81 (18.7)	23 (5.3)	13 (3)	77 (23.5)	31 (7.1)

¹Chi-square Test; **Fisher’s exact test.

¹Several children had multiple oral habits, resulting in a discrepancy between this number and the amount mentioned above for “any habit present.” The percentage is calculated for a total of 434 subjects

Table 4: Frequency distribution of oral habits present and age

Type of oral habit present ¹	Age (years)					P
	8	9	10	11	12	
Mouth breathing	23 (31.5)	18 (22.5)	19 (21.1)	15 (16.1)	16 (16.3)	0.108*
Tongue thrusting	9 (12.3)	5 (6.2)	8 (8.9)	5 (5.4)	8 (8.2)	0.535*
One side chewing	24 (32.9)	20 (25)	31 (34.4)	32 (34.4)	37 (37.8)	0.482*
Lip biting	5 (6.8)	5 (6.2)	16 (17.8)	4 (4.3)	8 (8.2)	0.013**
Cheek biting	2 (2.7)	3 (3.8)	3 (3.3)	7 (7.5)	4 (4.1)	0.570**
Pen/pencil/nail biting	36 (49.3)	40 (33.8)	31 (34.4)	14 (15.1)	2 (2.0)	< 0.001**
Grinding of teeth	12 (16.4)	10 (12.5)	13 (14.4)	10 (10.8)	10 (10.2)	0.728*

¹Chi-square test, **Fisher’s exact test

¹Several children had multiple oral habits, resulting in a discrepancy between this number and the amount mentioned above for “any habit present.” The percentage is calculated for a total of 434 subjects.

among 12-year-olds (22.4%) [Figure 2]. The average therapy requirement was highest in children with three or more oral behaviors (35.4%) and increased with negative habits. The majority of children with one oral cavity (17.9%) needed treatment [Figure 3].

DISCUSSION

Malocclusion is a condition that occurs throughout development.^[16] While some instances of malocclusion may have an obvious cause, most typically, it is the result of an intricate interplay of several variables that impact growth and development. Identifying a particular underlying cause is often not feasible. Nevertheless, the premature shedding of deciduous teeth and harmful oral behaviors, including thumb-sucking, tongue pushing, mouth breathing, and prolonged pen chewing,

may lead to unwanted tooth displacements, resulting in dental and facial misalignments.^[17] Given the prevalence of malocclusion, it is essential to provide information about oral healthcare for children to parents to mitigate malocclusion resulting from premature loss of primary teeth or detrimental practices. Poor oral habits increase the need for orthodontic treatment in adulthood as a result of tooth misalignment.

ANGLE MALOCCLUSION

The current study demonstrated a progressive reduction in malocclusion prevalence, with a specific sequence of decline. The order of kinds of malocclusion, based on Farid Bourzgui’s (2012) study on 8- to 12-year-old children in Morocco, is as follows: Angle class I malocclusion is more prevalent at 43.4%, followed

Table 5: Frequency distribution of malocclusion traits and age

Variables	Age (years)					P
	8	9	10	11	12	
Angle malocclusion						
Angle class I	25 (34.2)	16 (20.0)	24 (26.7)	23 (24.7)	27 (27.6)	< 0.001*
Angle class II	15 (20.5)	11 (13.8)	14 (15.6)	3 (3.2)	7 (7.1)	
Angle class III	12 (16.4)	12 (15.0)	16 (17.8)	25 (26.9)	35 (35.7)	
Unknown [†]	9 (12.3)	15 (18.8)	24 (26.7)	36 (38.7)	21 (21.4)	
Overjet						
> 4 mm	13 (16.4)	12 (16.2)	22 (24.4)	23 (24.7)	19 (19.4)	> 0.05**
< 0 mm (crossbite)	6 (8.2)	4 (5.0)	6 (6.7)	6 (6.5)	7 (7.1)	
Overbite						
> 4 mm	8 (11.0)	17 (21.2)	15 (16.7)	21 (22.6)	14 (14.3)	< 0.05**
< 0 mm (Open bite)	3 (4.1)	–	1 (1.1)	–	–	
Posterior crossbite						
Presence	68 (93.2)	76 (95.0)	83 (92.2)	84 (90.3)	78 (79.6)	< 0.01*
Absence	5 (6.8)	4 (5.0)	7 (7.8)	9 (9.7)	20 (20.4)	
Diastema midline						
≤ 2 mm	57 (78.1)	63 (78.8)	73 (81.1)	68 (73.1)	57 (58.2)	< 0.01*
> 2 mm	16 (21.9)	17 (21.2)	17 (18.9)	25 (26.9)	41 (41.8)	

*Chi-square test, **Fisher’s exact test.

[†]The molar relationships on the right and left sides were different

Table 6: The correlation between deleterious oral habits[†] and malocclusion

Variables		Presence	Absence	POR (95% CI)	P
Mouth breathing					
Anterior open bite	Presence	3 (3.3)	88 (96.7)	11.6 (1.2–113.4)	0.03**
	Absence	1 (0.3)	342 (99.7)		
Tongue thrusting					
Posterior crossbite	Presence	6 (17.1)	29 (82.9)	7.3 (2.5–21.4)	0.001**
	Absence	11 (2.8)	388 (97.2)		
Anterior open bite	Presence	3 (8.6)	32 (91.4)	37.3 (3.8–369.1)	0.002**
	Absence	1 (0.3)	398 (99.7)		
Overjet > 4 mm	Presence	22 (62.9)	13 (37.1)	8.4 (4.0–14.5)	< 0.001*
	Absence	67 (16.8)	332 (83.2)		
Angle class I malocclusion	Presence	15 (42.9)	20 (57.1)	2.2 (1.1–4.5)	0.022*
	Absence	100 (25.1)	299 (74.9)		
One side chewing					
Posterior crossbite	Presence	12 (8.3)	132 (91.7)	5.2 (1.8–15.0)	0.001*
	Absence	5 (1.7)	285 (98.3)		
Posterior open bite	Presence	12 (8.3)	132 (91.7)	2.8 (1.2–6.9)	0.017
	Absence	9 (3.1)	281 (96.9)		
Pen/ pencil/nail biting					
Diastema midline	Presence	37 (71.2)	15 (28.8)	1.9 (1.0–3.6)	0.041*
	Absence	215 (56.3)	167 (43.7)		

*Chi-square test, **Fisher’s exact test.

[†]Several children had multiple oral habits, resulting in a discrepancy between this number and the amount mentioned above for “any habit present.” The percentage is calculated for a total of 434 subjects

by Angle class III malocclusion at 37.7%, and Angle class II malocclusion at 18.9%. Angle class I malocclusion has a higher prevalence than Angle class II malocclusion, which in turn has a higher prevalence than Angle class III malocclusion. The percentages of prevalence are 61.4%, 24%, and 10%, respectively.^[18]

This was justified because the degree of misalignment of teeth was not consistent but rather varied across different research studies conducted in various nations around the world. Racial and genetic variables may be the cause of the disparity. This study found a high prevalence of Angle class III malocclusion across all

forms of malocclusion, consistent with Chu CH’s study in Hong Kong (31%).^[19] Angle Class III malocclusion is a type of dental misalignment caused when the maxilla is underdeveloped, the mandible overdeveloped, or a combination of both. Additionally, environmental factors, such as excessive impact from oral habits, also play a significant role in the development of Angle Class III malocclusion. The current study found a significant difference in the distribution of malocclusion angle classes I, II, and III based on age. The rate of angle class III malocclusion increased with age, which is consistent with K A Kolawole’s study in 2019. Kolawole *et al.*^[17] studied 130 children aged 6–12 years and observed that malocclusion changes as the teeth develop. Specifically, angle class III malocclusion increased with age, transitioning from primary dentition to permanent dentition. It is common for the first molar to move to the front of the mouth into the space left by the Leeway when the primary molar is lost early.^[20] This happens because the mandibular grows faster than the maxilla during adolescence, which also changes the position of the molars. The anterior–posterior dimension may be responsible for the increase in Angle III with age.

DELETERIOUS ORAL HABITS

The proportion of male children afflicted (29.3%) was twice as high as that of female children (13.3%), and this difference was statistically significant with a very low *P* value < 0.001 based on a χ^2 test. The study conducted by Kharbanda *et al.*^[21] in India on children aged 5–13 years indicated that a higher percentage of male children (7.8%) had problematic mouth breathing habits compared to female children (5.3%), with a statistically significant difference (*P* < 0.001). In contrast to Garde’s^[9] research, which indicated that females had a higher prevalence of mouth breathing practices compared to boys; the author attributed this difference to hormonal shifts and dietary factors in female children aged 6–12 years old. Studies have shown a statistically significant association between mouth-breathing practices and anterior open bites. On the other hand, Giugliano *et al.*^[22] found a positive association between deleterious oral habits and malocclusions; however, there was no significant relationship between the type of oral habits and malocclusions. This study has proven that different oral habits contribute to the development of defective primary tooth occlusions. The impact of these habits was greater if they persisted for more than 3 years.

The study found that there was a correlation between tongue thrusting and the development of posterior crossbite in children. This can be explained by the fact that, in addition to observing the child’s tongue thrusting during swallowing and speaking, we diagnosed the tongue thrusting habit through clinical examination. During this examination, we also measured the child’s tongue size and position at rest. The tongue protruded over the occlusal surface of the posterior, causing the lower back teeth to sink and tilt, which might be the underlying factor contributing to the development of a

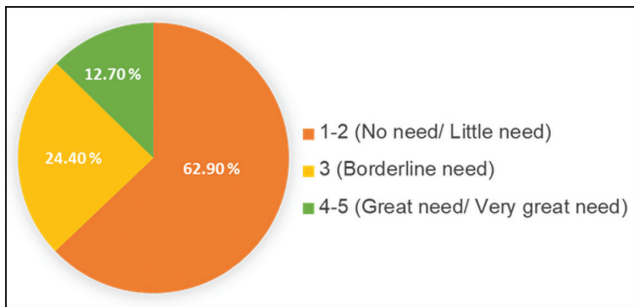


Figure 1: The index orthodontic treatment need of the study sample

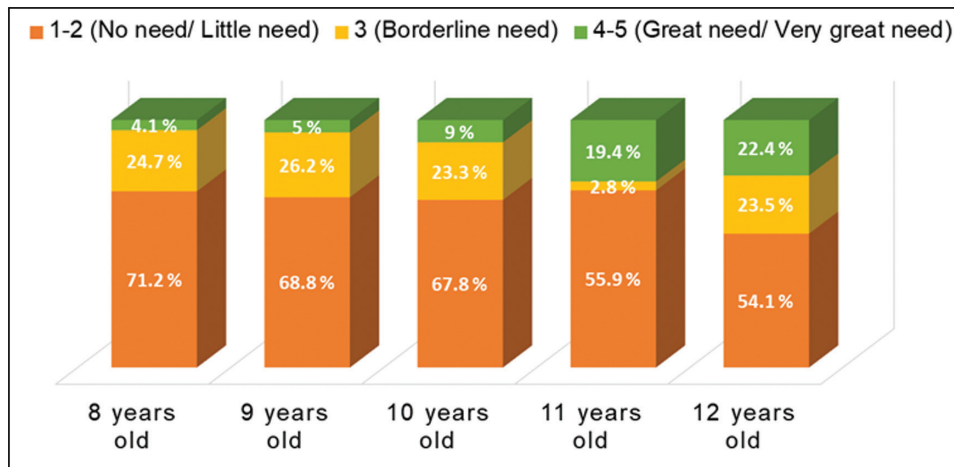


Figure 2: The index orthodontic treatment need by age groups

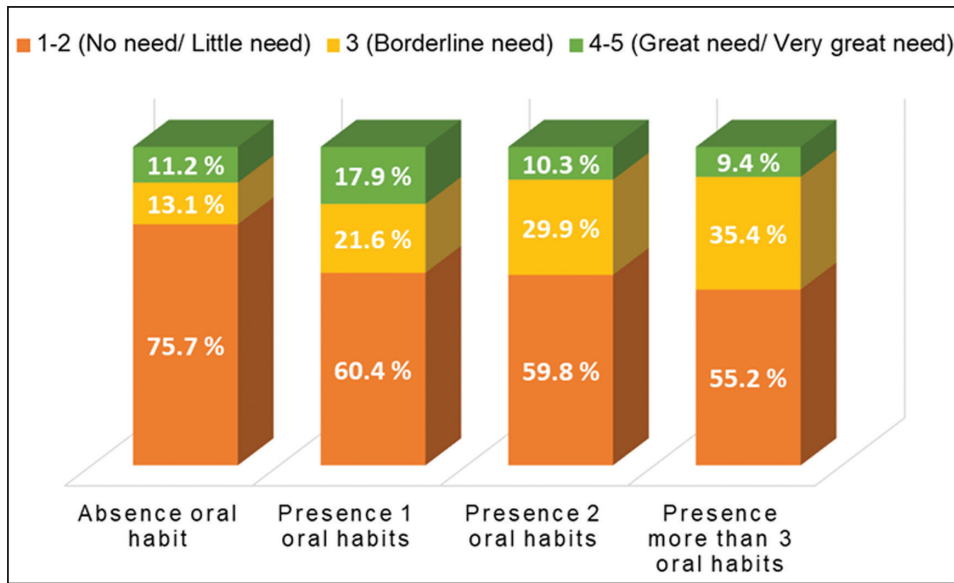


Figure 3: The index orthodontic treatment need by the presence of oral habits

posterior crossbite. The present research documented the prevalence of anterior open bites in children who exhibit tongue thrusting. The prevailing consensus is that the duration of tongue pressure on the front teeth while swallowing is insufficient to result in tooth movement or the development of an open bite. According to Proffit, an open bite is more likely to result in a tongue thrust swallow than the other way around. Therefore, in this circumstance, tongue thrust may be a result of malocclusion. Tongue thrusting is a deliberate action that involves closing the mouth cavity while swallowing. This behavior is considered to be adaptive.^[23] Kothari *et al.*^[24] found it challenging to thoroughly assess tongue motions using basic clinical observation alone. If circumstances permit, it is possible to use highly specialized equipment such as electropalatography, cineradiography, IRM, and ultrasonography to conduct a more comprehensive investigation of this habit. Thumb-sucking was a common behavior in early childhood. Nevertheless, this investigation did not document any instances of thumb-sucking. This may be attributed to the age group selected for our study, which consisted of children aged 8–12 years. This decision was based on the consensus among writers worldwide that the majority of children cease this behavior before the age of 6 years, as demonstrated by Silva Filh’s research. In 2003, the study showed that the prevalence of thumb-sucking in children reduced progressively from 66.23% at the age of 3–17.14% at the age of 6 years.^[25]

THE IOTN

Two European studies, one conducted in Spain and another in Italy, revealed a relatively low percentage of

children requiring orthodontic treatment compared to the findings of the research. The current investigation found prevalence rates of 21.8% and 27.3%.^[26,27] This phenomenon can be attributed to the fact that in Europe, proactive and corrective orthodontic procedures are carried out at an early stage in children, and students have easy access to dental care. This minimizes the premature removal of primary teeth, thereby preventing tooth decay and the subsequent reduction in primary tooth width. This reduction in width leads to the loss of space and the potential crowding of future teeth.^[28]

At every level of treatment necessity, this study discovered that the percentage of students requiring treatment increased as they got older, and this disparity was statistically significant (χ^2 test, $P < 0.01$). Among the students, those who were 12 years old had the highest rate of treatment need, at 22.4%, followed by 11-year-old students with a rate of treatment need of 19.4%. The research by Onyeaso^[29], which found that untreated malocclusion worsens with age, particularly after the permanent teeth have fully developed, aligns with this finding.

This current study found a statistically significant correlation between the number of negative behaviors shown by children and the need for orthodontic treatment. This phenomenon may be elucidated by considering that when a kid engages in just one detrimental oral habit, the specific region where the force is exerted experiences localized impact, intensity, and length. As a result, there is increased need for orthodontic treatment in children.

The deterioration of school dentistry over the past decade is a warning sign for malocclusion, as well as for tooth erosion and gingivitis. This has prompted policymakers to adjust their plans to accommodate the new circumstances. The Vietnamese dental industry has mastered and consistently implemented a variety of new and advanced treatment techniques, utilizing modern materials and apparatus. Nevertheless, a significant number of individuals in rural and mountainous regions are either uncared for or have difficulty accessing medical examination, treatment, and oral healthcare services, particularly in remote, isolated, frontier, and island regions. Dental physicians' technical proficiency is inconsistent, and certain district hospitals do not have dental doctors. A lack of human resources and treatment equipment impedes the management of oral diseases and oral-maxillofacial surgery, including cancer, maxillofacial trauma, congenital malformations of the maxillofacial region, maxillofacial plastic and cosmetic surgery, temporomandibular joint disease, and jaw deformities. Furthermore, the lack of a connection between public and nonpublic health facilities has diminished the operational efficacy in treating and caring for community oral health issues. To enhance dental healthcare services in Vietnam, the potential effects on resource allocation, education and training programs, and preventative measures must be considered. Furthermore, we investigate the possibility of establishing partnerships with international organizations to improve dental services and address any identified care deficiencies. One potential solution is to improve health education and communication among the general public.

By providing teachers with training on appropriate oral hygiene practices and maintaining, developing, and implementing school-based oral health education programs, these issues could be addressed at an early age. Furthermore, collaborating with international organizations to attract experts to conduct workshops and seminars on preventive measures could further enhance the knowledge and skills of dental practitioners in Vietnam.

The study has significant limitations due to its small sample size and its oversimplified assessment criteria for patients with deleterious oral habits. It was necessary to conduct a thorough study with the assistance of specialists in otolaryngology and specialized diagnostic centers, as well as an increased sample size. There are numerous factors to consider. To start, we cannot say anything about the association between childhood behaviors and malocclusion since our study was cross-sectional. Second, to design therapies to prevent malocclusion in children, future research should include

variables such as dietary patterns and parental behaviors surrounding oral healthcare. At last, this research did not include any data on families' socioeconomic status, nutritional status, or dietary habits. Consequently, more research into the connections between these factors and malocclusion is necessary.

CONCLUSION

The results demonstrated that students in primary schools in the southern region of Vietnam had a very high incidence of malocclusion, primarily in Angle Class I. When designing treatments for malocclusion, it was vital to keep in mind the roles played by harmful behaviors such as mouth breathing, tongue pushing, biting nails or pens, and eating on one side of the mouth. Improving initiatives to eliminate deleterious oral habits should be a top priority for the relevant governments.

ACKNOWLEDGEMENT

The authors are grateful for the financial support provided by the Faculty of Odonto and Stomatology, Can Tho University of Medicine and Pharmacy.

FINANCIAL SUPPORT AND SPONSORSHIP

Nil.

CONFLICTS OF INTEREST

There are no conflicts of interest.

AUTHORS CONTRIBUTIONS

(1) Concept or design: All authors. (2) Acquisition of data: All authors. (3) Analysis or interpretation of data: All authors. (4) Drafting of the article: All authors. (5) Critical revision for important intellectual content: All authors. All authors had full access to the data, contributed to the study, approved the final version for publication, and take responsibility for its accuracy and integrity.

ETHICAL POLICY AND INSTITUTIONAL REVIEW BOARD STATEMENT

Ethics Committee Approval: Ethics committee approval was received for this study from the Ethics Committee in Biological Research of Can Tho University of Medicine and Pharmacy.

PATIENT DECLARATION OF CONSENT

Not applicable.

DATA AVAILABILITY STATEMENT

Not applicable.

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